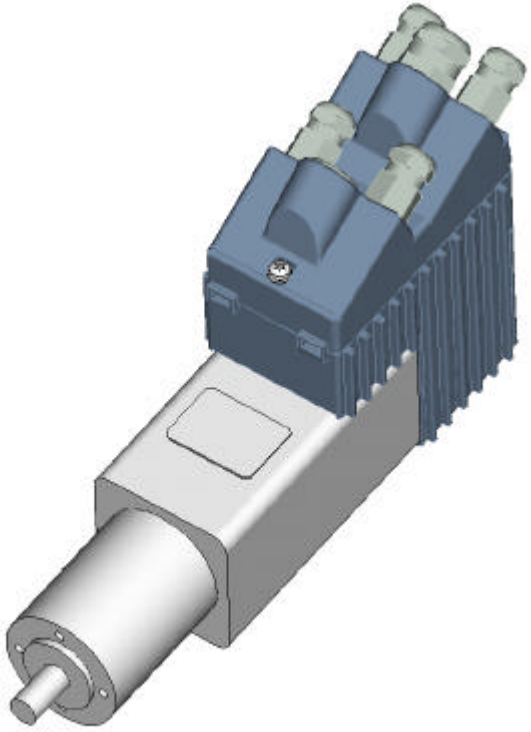
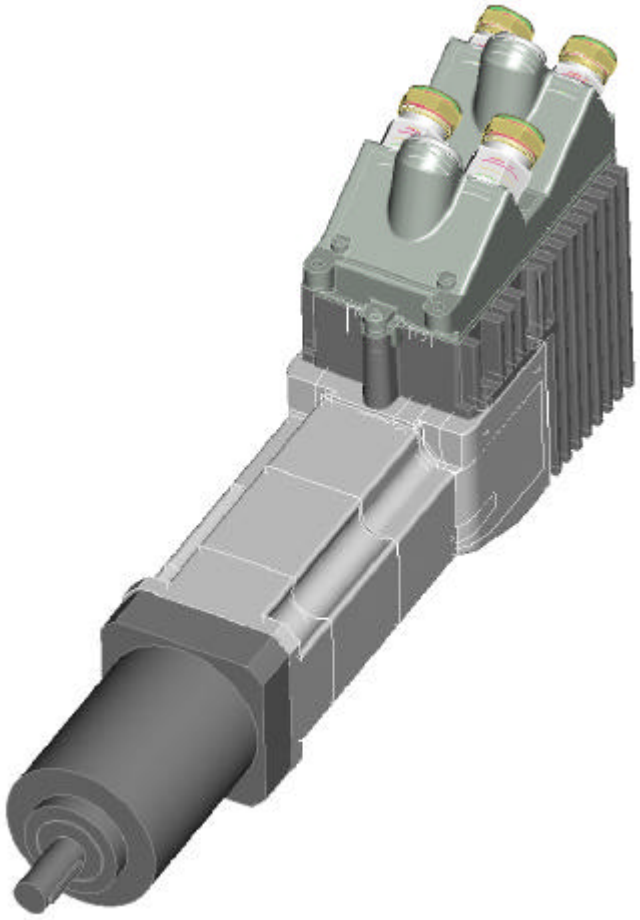
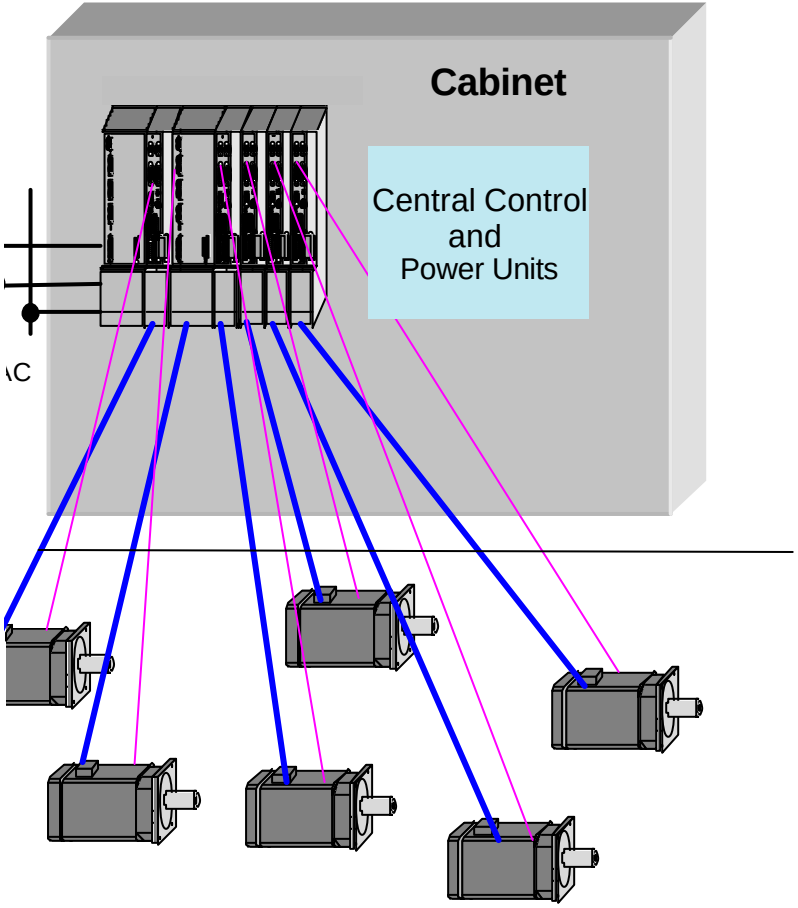
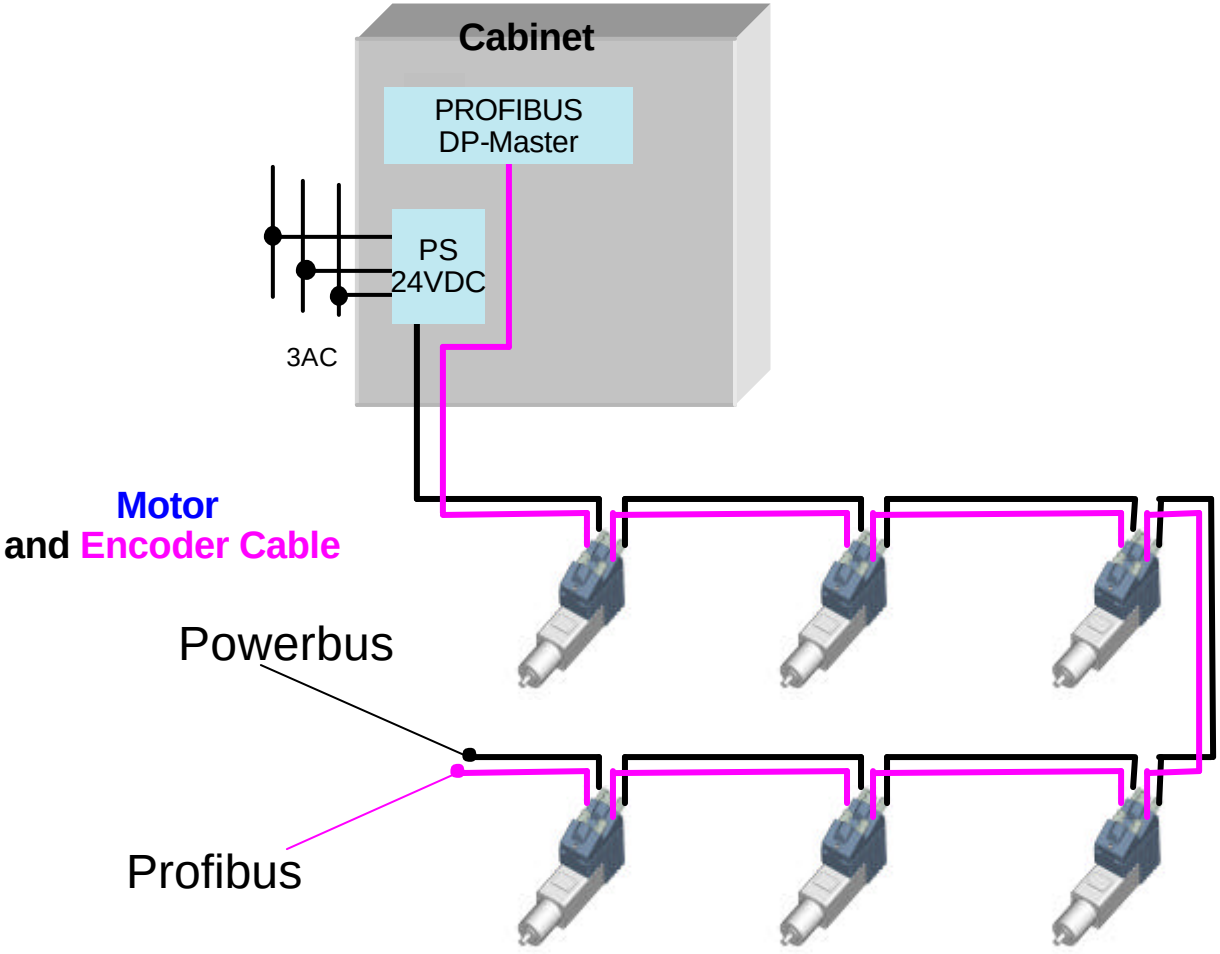
# Intelligent Positioning Motors on PROFIBUS DP





# Centralized / Decentralized Drive Technology



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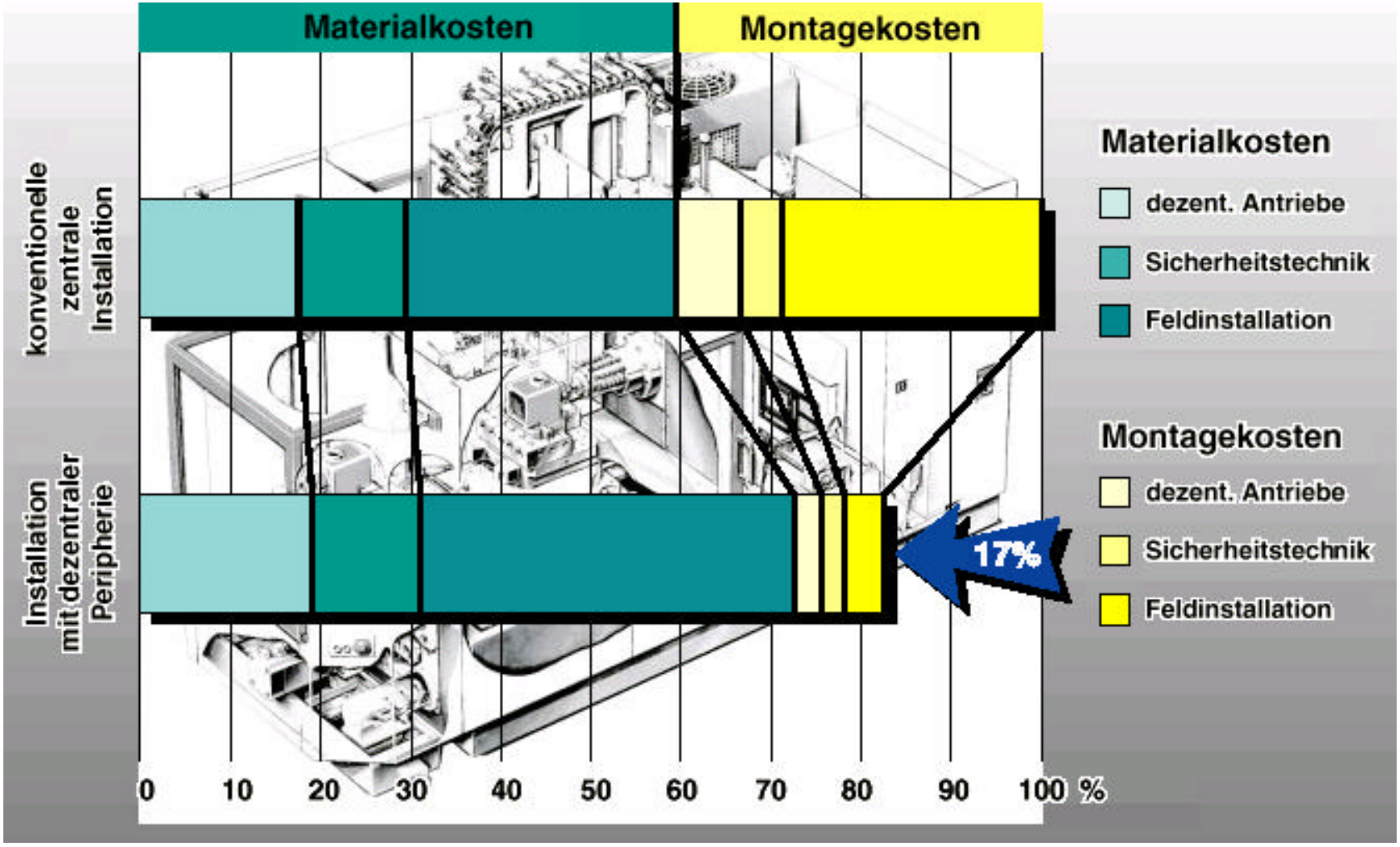
# Advantages of distributed drive technology

- Central machine control is relieved of positioning tasks
- Units and subsets of machines can be independently started without involving the central control
  - Distributed intelligence
- Configuring/engineering costs of the hardware are reduced
  - Interfaces reduced
- Coupling to the system is simplified
  - Standard PROFIBUS protocols
  - Programming using standard tools
- Productive using shorter equipping times for automatic adjustment of formats and end stops

# Results of iwb*-Study
# Cost analysis BAZ

* Institute for Machine Tools and Economy
TU München



# Product profile
# Basic features

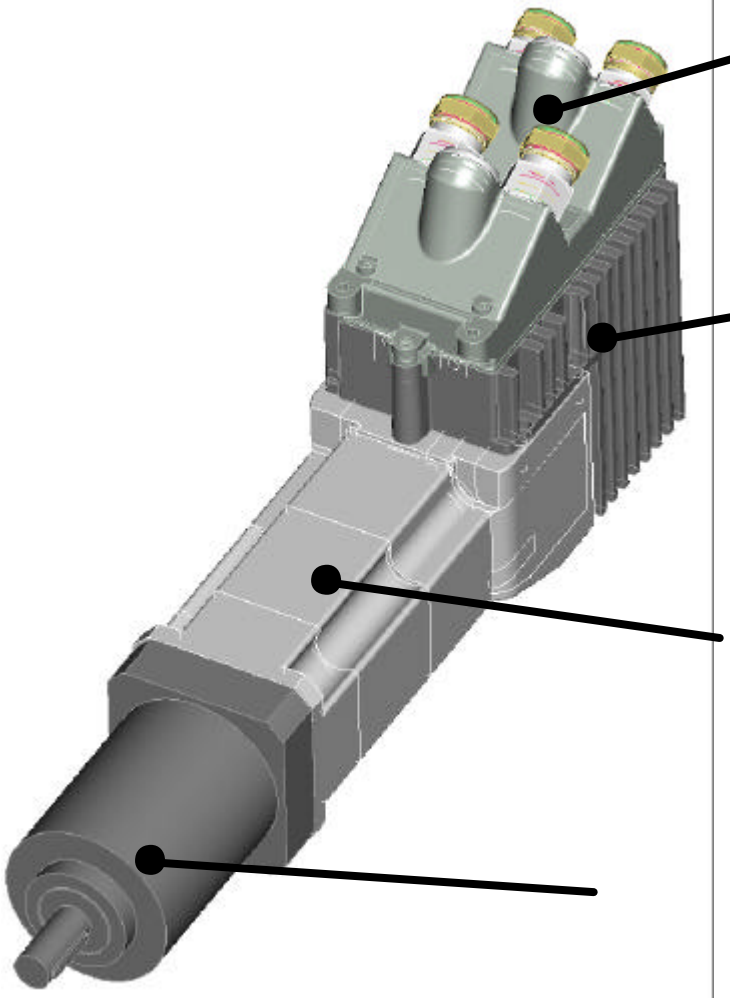
SIMODRIVE POSMO A is an intelligent, distributed positioning motor connected to PROFIBUS-DP

## Basic features

- Onboard closed-loop control and power module
- Connected via the communications and power bus
- PROFIBUS DP standard slave
- positioning functionality on board

***SIMODRIVE POSMO A with its consequentially distributed concept is establishing a new level in Drive technology***

# Product profile
# Basic features (1)

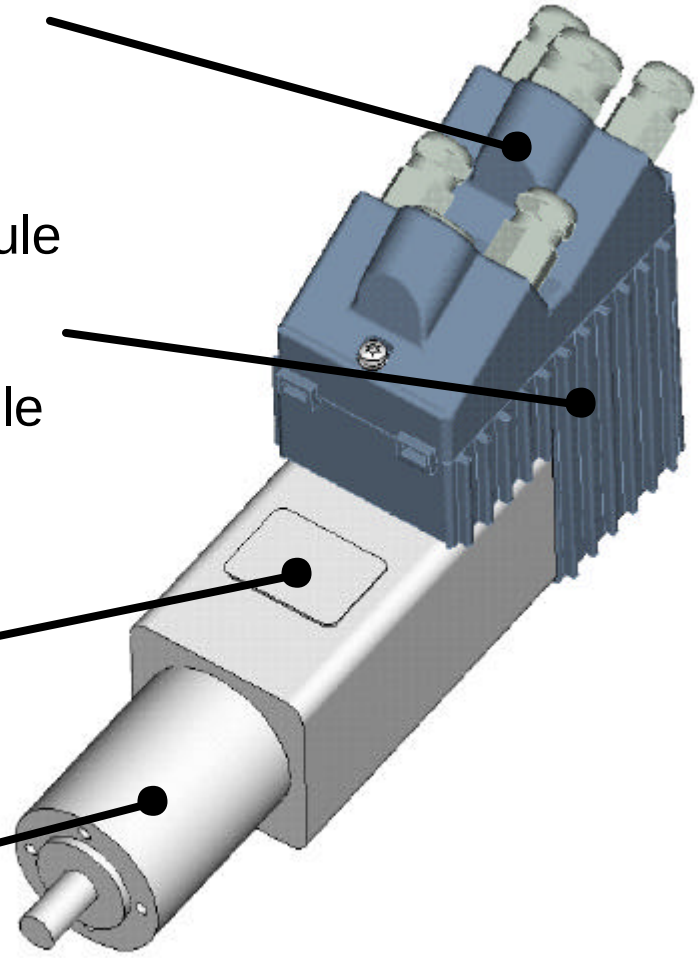


Connecting cover

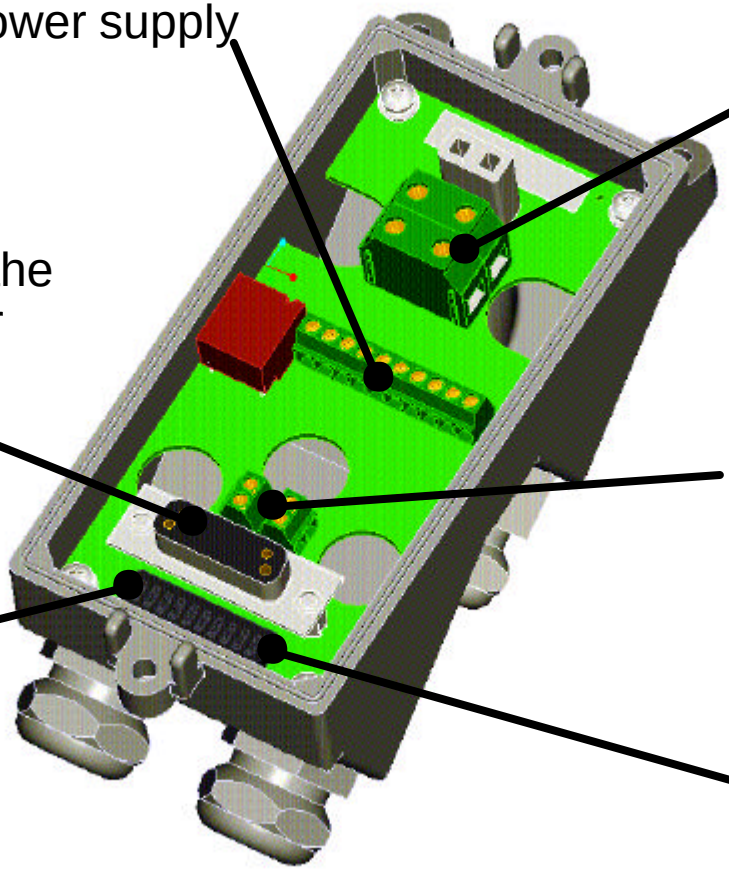
Converter power module
positioning control
program memory
communication module

Brushless DC-Motor

Planetary
gear



# System data
# Connection cover



# Typical applications and industry sectors

## Typical applications include:

- ☞ Adjusting formats and end stops
- ☞ Adjusting process quantities (e.g. via valves)
- ☞ or simply just positioning

## Application areas include among others:

- ☞ Production machines for packaging, woodworking, glass, plastic and printing technology
- ☞ Medical diagnostics
  Moving examination tables or x-ray equipment
- ☞ Machine tools and transfer lines,
  simple adjusting tasks

# General System Data (1)

- **Cooling:**
  self-cooled without fan
- **Gearbox Variations**:
  Planetary gear
  Worm gear
  without gear
- **Two terminals, parameterizable as inputs or outputs**

☞ Reading BERO signals for referencing

☞ Trigger signal for the integrated positioning functions

☞ Initiating pulse cancellation at the inverter

☞ Control signal for braking or clamping devices

# General System Data (2)

## T-Functionality

### With the connection cover removed

- ❑ All of the cable connections are retained
- ❑ PROFIBUS communication continues to function
- ❑ The power supply for subsequent/downstream systems is maintained

☝ Cable outlet as standard: In the direction of the drive shaft, cable outlet can be rotated through 180°

# System data
# Closed-loop control and diagnostics

## Closed-loop control Data

| | | |
|---|---|---|
| ☞ Cl.-loop position control | P controller, | 10 ms clock cycle |
| ☞ Cl.-loop speed control | PI controller, 4 quadrants, | 1 ms clock cycle |
| ☞ Cl.-loop current control | PI controller, $I^2t$ limiting, | 125 µs clock cycle |

## Diagnostics

| | | |
|---|---|---|
| ☞ PROFIBUS DP | Standard diagnostics | |
| ☞ Display | via LED: | **Fault / ready** |
| ☞ Diagnostic sockets | 2 parameterizable analog outputs for service purposes | |

# Technical Data 75 W

| | |
|---|---|
| ☞ Rated voltage | 24 $V_{DC}$ +/- 20 % |
| ☞ Rated power | 75 W (S3 25%, 1min) |
| ☞ Rated speed | 3300 RPM |
| ☞ Rated torque | 0.36 Nm (S3 25%, 1min) |
| ☞ Rated current | 4.5 A (S1) |
| ☞ Pos. measuring System | incremental, TTL-Signals, 816 P/R |
| ☞ Protection class | IP 54 |
| ☞ Weight | approx. 3,7 kg |
| ☞ Ambient Temperature | 0...45 °C (up to 65° C with derating) |

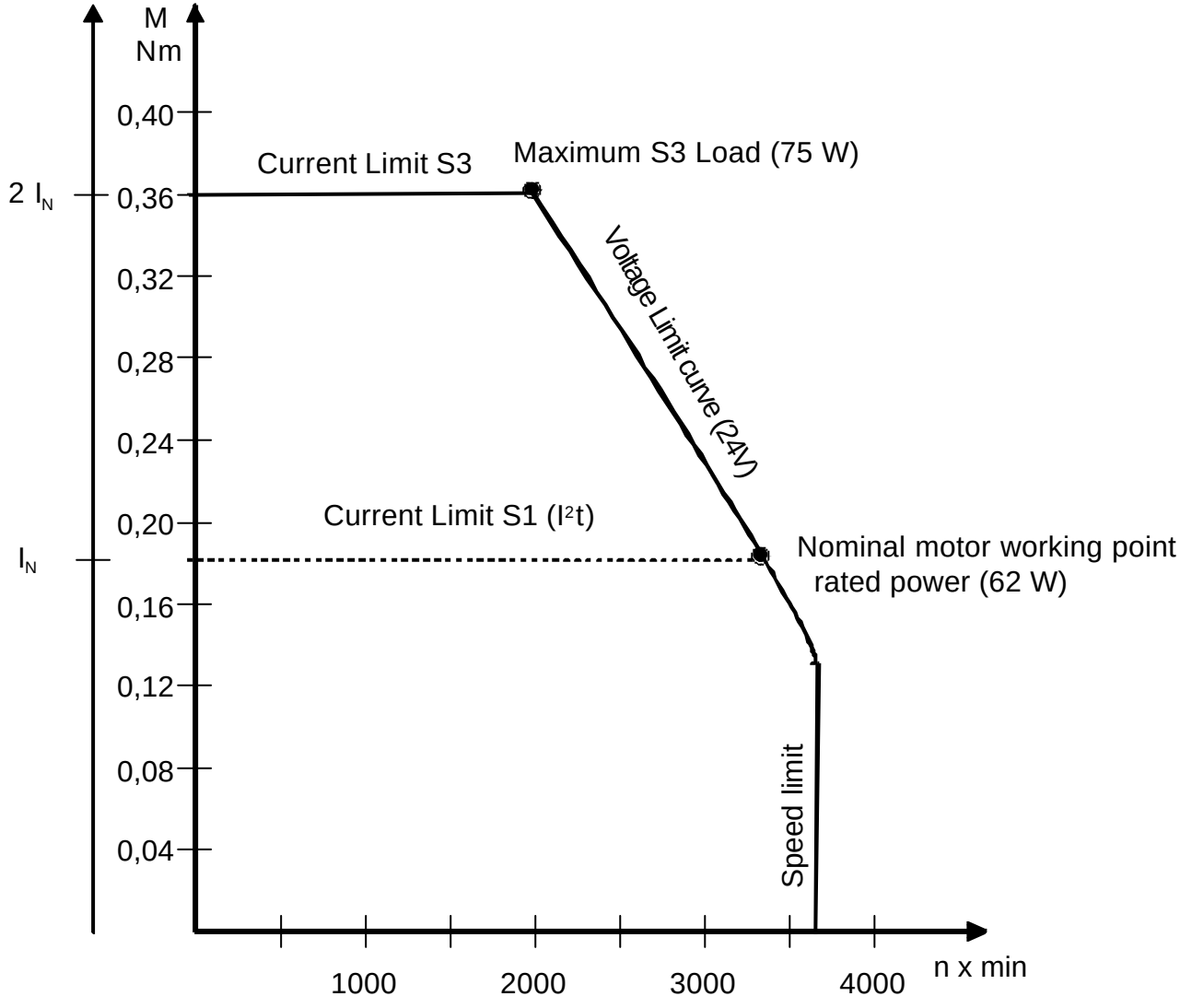
# Modular gearbox 75 W

*) permissible continuous gearbox torque briefly , for example for approaching can be overloaded by a factor of 2

| Type | No. of stages | Ratio | Efficiency | $M_{perm\ S1}$ * [Nm] | $M_{S1}$ [Nm] | $M_{S3}$ ** [Nm] | n [RPM] |
|---|---|---|---|---|---|---|---|
| PLG | 1 | 4,5 | 0,85 | 1,2 | 0,7 | 1,4 | 733 |
| | | 8 | 0,85 | 1,2 | 1,2 | 2,4 | 413 |
| | 2 | 20,25 | 0,72 | 8 | 2,6 | 5,2 | 163 |
| | | 36 | 0,72 | 8 | 4,7 | 9,3 | 92 |
| | | 50 | 0,72 | 8 | 6,5 | 13,0 | 66 |
| | 3 | 126,6 | 0,61 | 24 | 13,9 | 27,8 | 26 |
| | | 162 | 0,61 | 24 | 17,8 | 35,6 | 20 |
| w/out gearbox | | - | - | - | 0,18 | 0,36 | 3300 |
| SG | | 5 | 0,7 | 2 | 0,6 | 1,3 | 660 |
| | | 24 | 0,5 | 3,5 | 2,2 | 4,3 | 138 |
| | | 75 | 0,25 | 4 | 3,4 | 6,8 | 44 |

**) S3: 25% switch-on duration 60s
Example 15 s traversing
45 s interval

# Torque-Speed Diagram 75W



# Technical Data 300 W

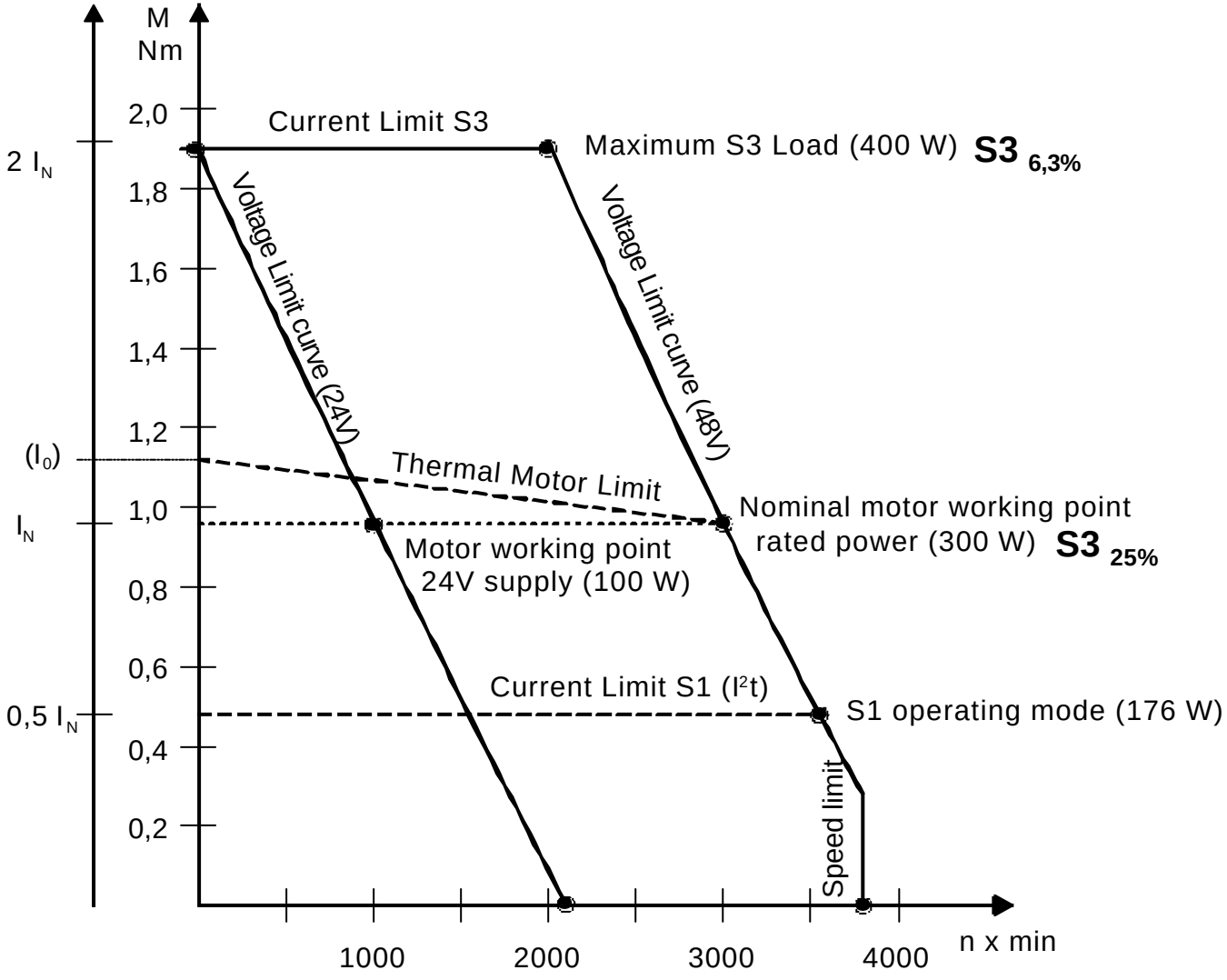
| | |
|---|---|
| Rated voltage | 48 $V_{DC}$ ± 20% |
| Rated power | 300 W ($S3_{25\%}$) at 48V and 3000 $min^{-1}$ |
| Rated speed | 3000 $min^{-1}$ |
| Rated torque | 0.95 Nm at $S3_{25\%}$ |
| Rated current | 5 A (S1) 10A ($S3_{25\%}$) |
| Pos. measuring System | incremental, TTL-Signals, 4096 P/R |
| Brake | optional Holding Brake |
| Protection | IP 54 |
| Weight | 4,0 - 5,5 kg |
| Ambient Temperature | 0...45 °C (up to 65° C with derating) |

# Modular gearbox 300 W

| Typ | Stages | Ratio | Efficiency | M S1 [Nm] | M S3 25% [Nm] | M S3 6,3% [Nm] | $n_2$ [$min^{-1}$] |
|---|---|---|---|---|---|---|---|
| PLG | 1 | 4 | 0,90 | 1,7 | 3,4 | 6,8 | 750 |
| | | 7 | 0,90 | 3,0 | 6,0 | 12,0 | 429 |
| | 2 | 12 | 0,85 | 4,9 | 9,7 | 19,4 | 250 |
| | | 20 | 0,85 | 8,2 | 16,2 | 32,3 | 150 |
| | | 35 | 0,85 | 14,3 | 28,3 | 44,0 | 86 |
| | | 49 | 0,85 | 20,0 | 39,6 | 44,0 | 61 |
| without Gear | | - | - | 0,48 | 0,95 | 1,90 | 3000 |

$M_{S3\ 25\%}$: Switch on duration:60 s, Cycle time: 4min
$M_{S3\ 6,3\%}$: Switch on duration:15 s, Cycle time: 4min

# Torque-Speed Diagram 300W



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# Functionality - positioning (1)

| | |
|---|---|
| ☞ **Rotary axis / linear axis** | Dimension units mm/inch/degrees |
| ☞ **Jerk limiting** | To reduce the stressing on the mechanical system |
| ☞ **Flying block change** | For rounding-off |
| ☞ **External block change** | |
| ☞ **Programmable signaling position** | |
| ☞ **Actual value setting** | For referencing |
| ☞ **Travel to end stop** | Can be emulated |
| ☞ **Backlash compensation** | |
| ☞ **Software limit switch** | |
| ☞ **Braking Management** | |

# Functionality - positioning (2)

Integrated positioning functionality and programmable motion sequence

| | |
|---|---|
| ☞ **'Move absolute to'** | End position, at velocity and acceleration with override |
| ☞ **'Move relative'** | A distance in a direction with velocity and acceleration with override |
| ☞ **'Move with'** | Speed and acceleration with override, direction via sign, until a time or logic operation is fulfilled |
| ☞ **'Move as soon as'** | An additional time-or logic operation is fulfilled |
| ☞ **'Move as long as'** | A time or logic operation is fulfilled |
| ☞ **'Move and report'** | from a position a pre-defined byte combination |

# Functionality - positioning examples

- **'Move to'** (absolute) — 100 mm at v=55% a=30%
- **'Move for'** (relative) — 150 mm in positive Direction at v=100% and a=80%
- **'Move with'** (speed-controlled) — n=60 % for eternity (S1-Operation)

Additional logical combinations:

- **'Move as soon as'** — a Timer has expired and / or an Input is not active
- **'Move as long as'** — a Timer is running and / or an Input is active
- **'Move and report'** — at Position 266 mm a pre-defined byte combination

# Functionality referencing (pre-assigned actual position)

- **Referencing with BERO signal**
  If the BERO signal is present, a defined value is read from a machine data for referencing.

- **Referencing with saved actual value**
  The actual position is saved at power-off, and is read-in for referencing at power-up.

- **Referencing with 'move to fixed end stop'**
  The drive traverses with a defined torque to a mechanical end stop (e.g. at the end of a traversing path). A defined value is then read-out of a machine data for referencing.

- **Referencing via an external multi-turn absolute value encoder**
  The PROFIBUS master reads the actual value from the encoder via PROFIBUS and transfers this for referencing.

# Functionality - "SIMULATIONS OPERATION"

- **POSMO A operates as "stand alone" (without Profibus)**

  ❶ **Programming the positioning task with start-up tool**

  The traversing task is programmed decentrally at the drive using a notebook, PC or PG.

  ❷ **Disconnecting Profibus**

  The drive starts with a pre-defined traversing block as single block or program with optional block change enable conditions.

  Example: 4 different positions are approached using 2 switches or Beros

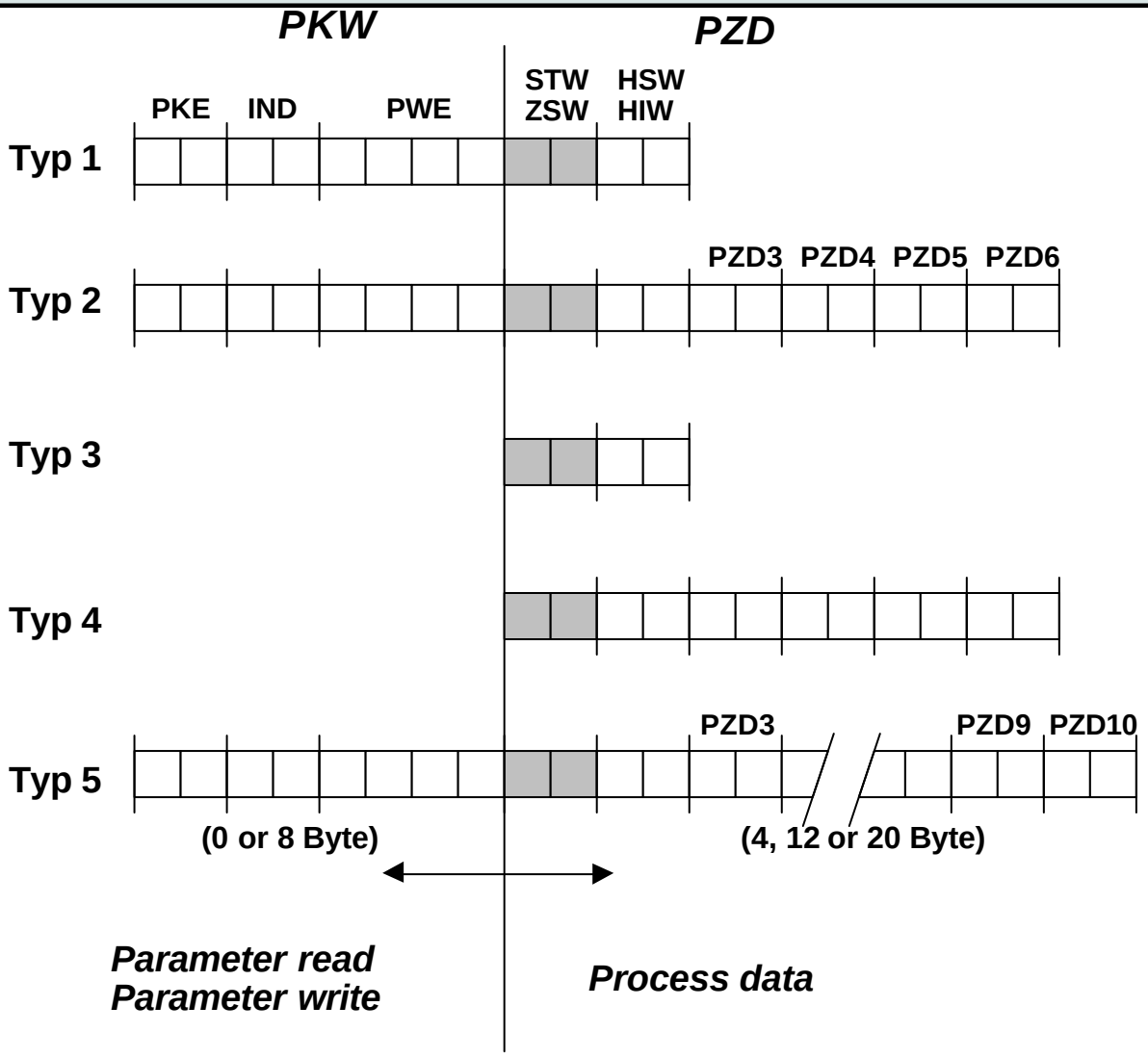
# Communication PROFIBUS DP (1)

**Siemens SPC3 PROFIBUS controller is used to connect to the bus.**

## The SPC3

- ☞ **automatically sets itself to the selected data transfer rate between 9.6 kbaud and 12 Mbaud,**
- ☞ **informs the user about received data and generates autonomous responses for the master**
- ☞ **saves all of the data in its 1.5 Kbyte dual-port RAM**

# PPO Types of PROFIDRIVE Profile (PKW/PZD Channel)



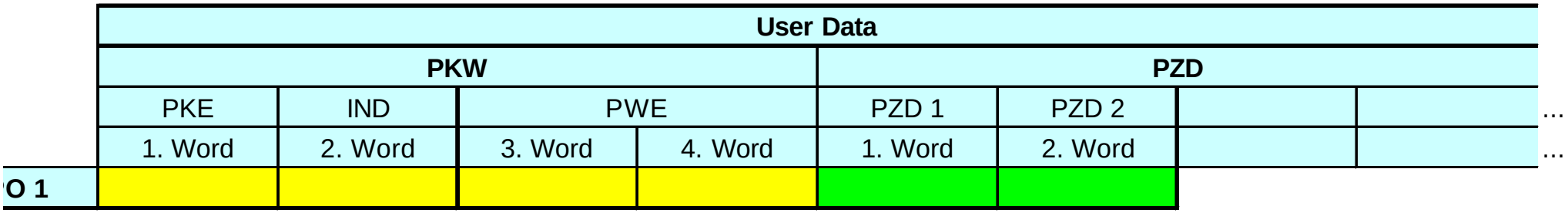

**Cyclic process data-transfer**

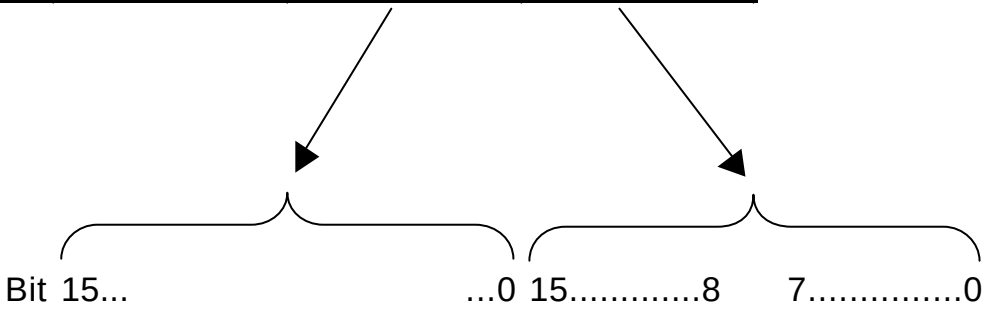
**non-cyclic Parameter channel**

*Abbreviations*

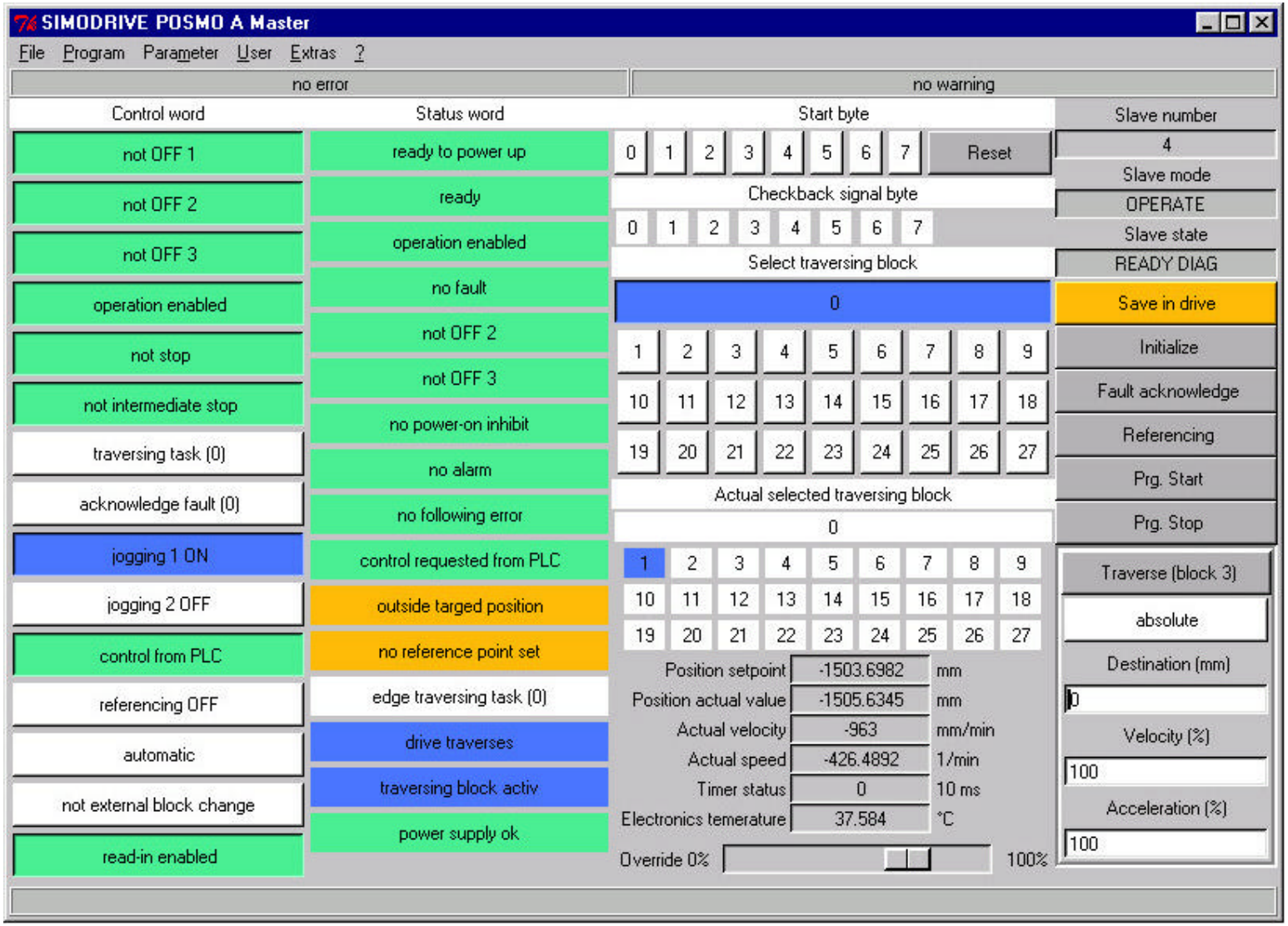
| | |
|---|---|
| PPO | Parameter Prozeßdaten Objekt |
| PKW | Parameterkennung Wert |
| PZD | Prozeßdaten |
| PKE | Parameterkennung |
| IND | Subindex |
| PWE | Parameterwert |
| STW | Steuerwort |
| ZSW | Zustandswort |
| HSW | Hauptsollwert |
| HIW | Hauptistwert |

# Profibus - Communication with PPO 1



# Start-up Tool „POSMO A Master“ (1)



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# Start-up Tool „POSMO A Master“ (2)

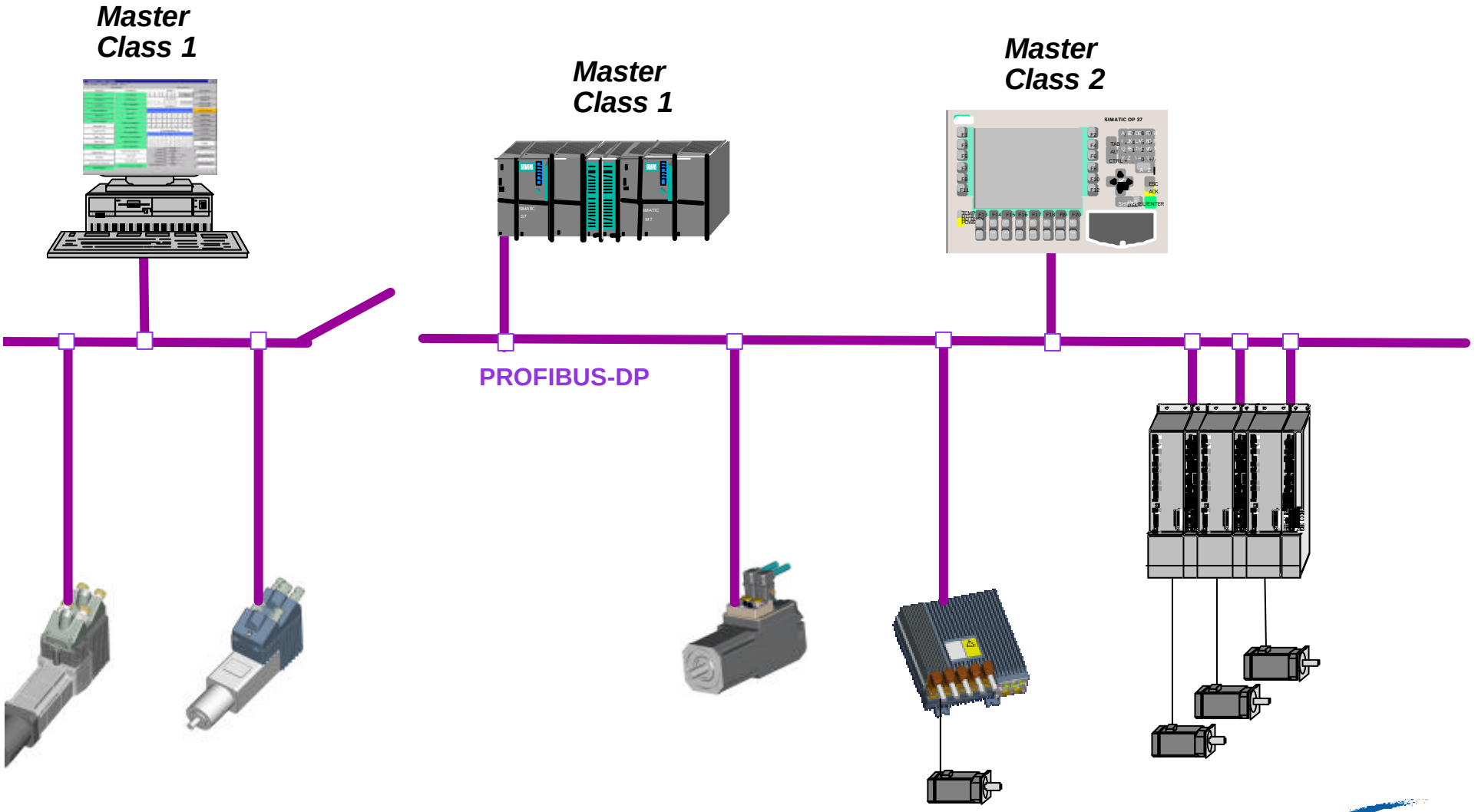
## ☞ For all POSMO A up to Version 1.4.x (H)

- POSMO A as DP Normslave only to be operated at PROFIBUS Master Class 1 only (cyclic Duties).
- because no DP/V1 Duties (acyclic Duties) available in older POSMO A

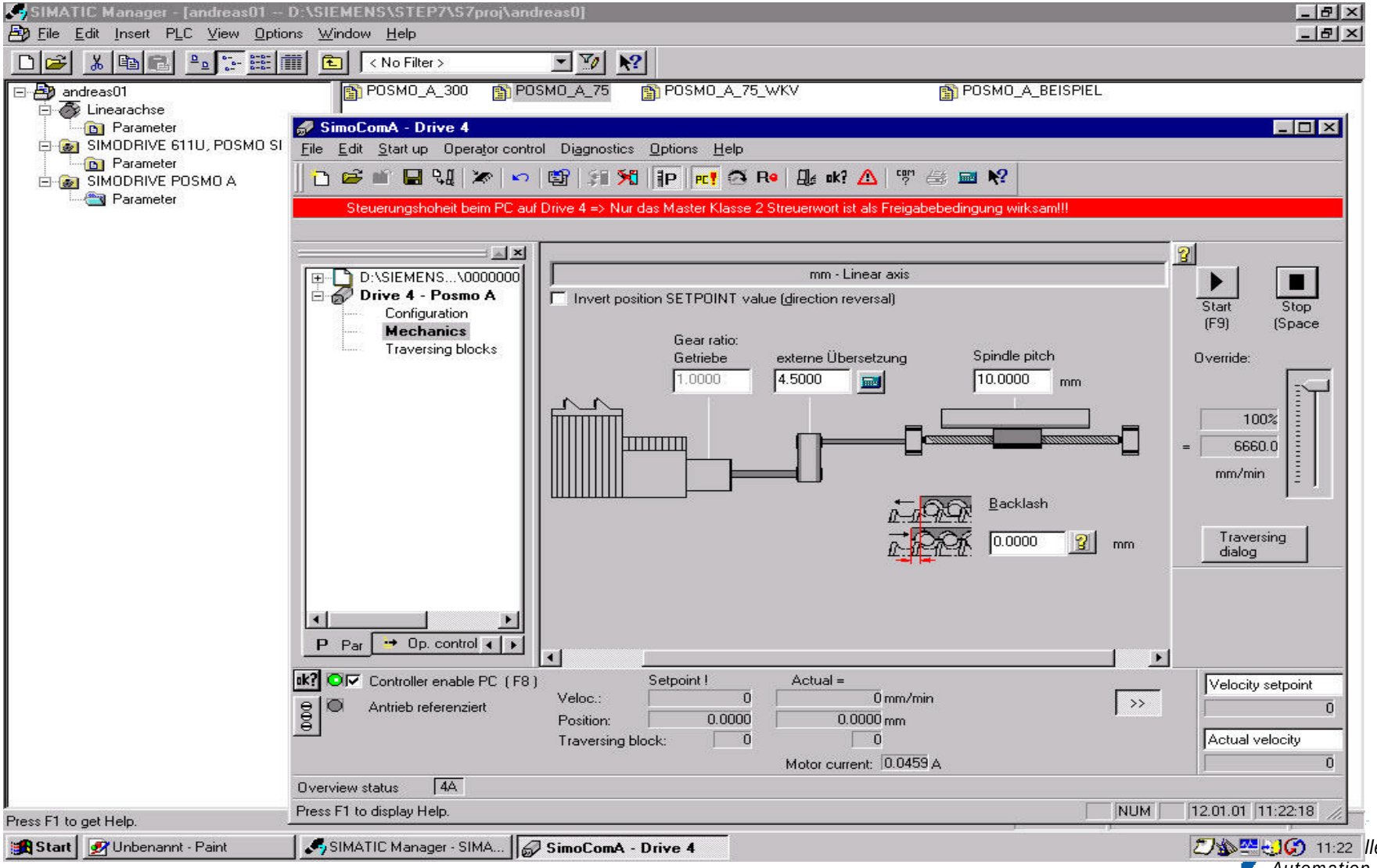
## ☞ Requirements

- IBS-Tool „POSMO A Master“
- TCL Interpreter Version 8.0
- Master capable (Class 1-Master) PC/PG/Notebook
  - ↳ Communication processor CP5511(PCMCIA) or CP5611or CP5412
  - ↳ Softnet DP - from SIMATIC NET

# Start-up Tool „POSMO A Master“ (3)



# Start-up Tool „SimoCom A“ (1)



# Start-up Tool „SimoCom A“ (2)

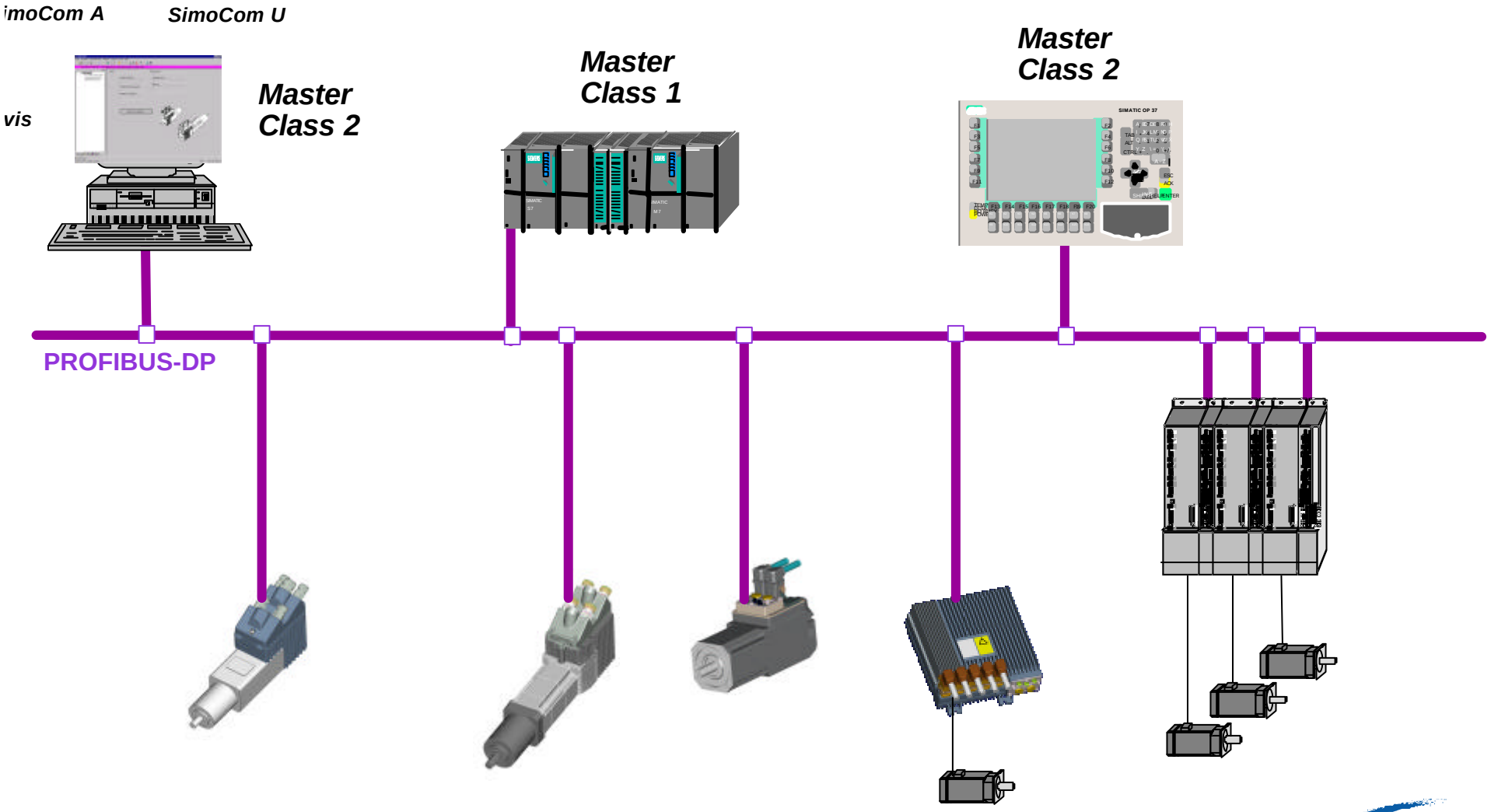
## For all POSMO A from Version 1.5.x (J) on

- DP/V1 and S7-Duties implemented (acyclic Duties)
- POSMO A can be operated at PROFIBUS Master Class 2

## Requirements

- PC/PG/Notebook
  - Communication processor CP5511(PCMCIA) or CP5611or CP5412
  - MPI Interface

# Start-up Tool „SimoCom A“ (3)

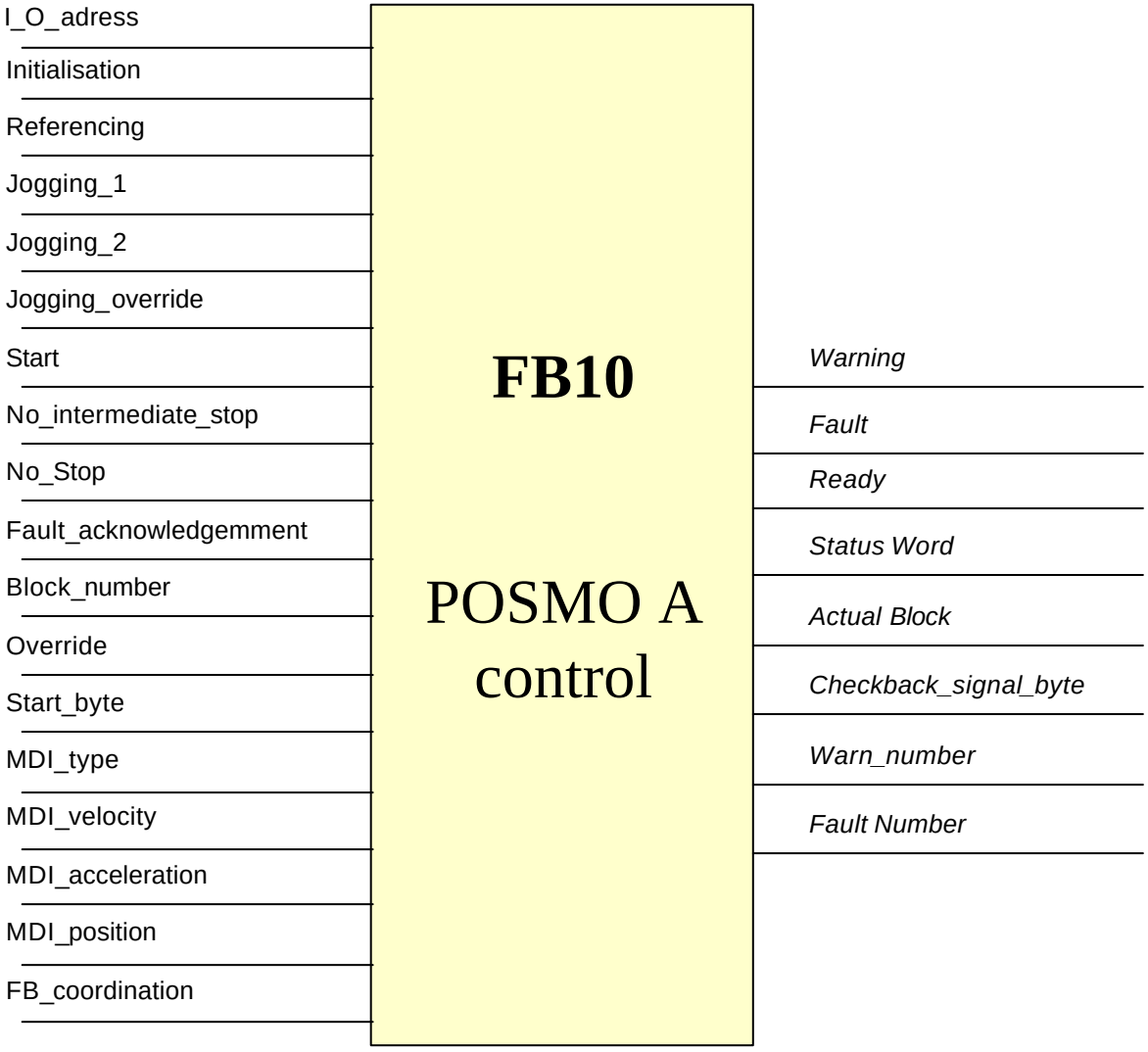


# Start-up Tool „SimoCom A“ integrated in DRIVE ES

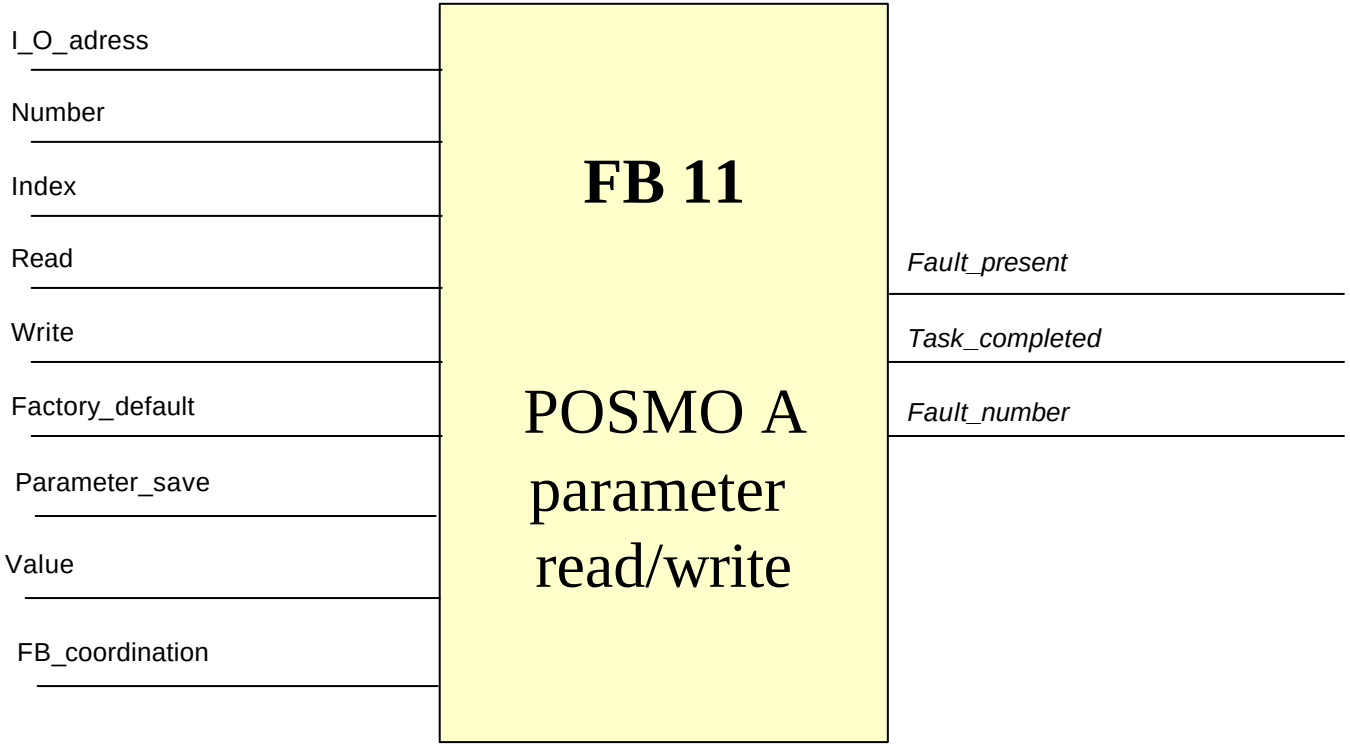
## SimoCom A will be integrated as Drive-Monitor in DRIVE ES BASIC

- for Customers using POSMO A in great plants and machines together with several other PROFIBUS-drives
- for Customers using DRIVE ES in TIA-conform machines and plants requiring following criteria:
  - joint communication
  - joint programming / parameterizing
  - joint data store

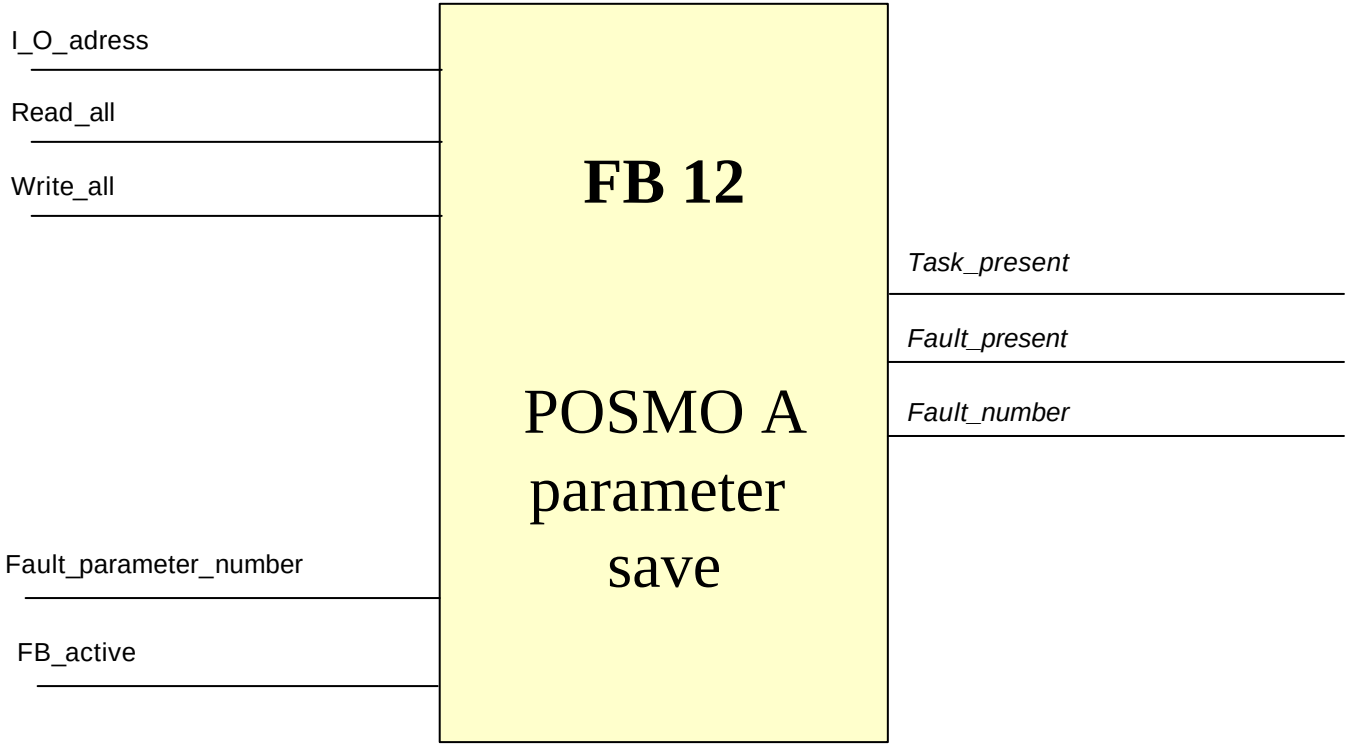
# SIMATIC- Function block for easy programming in S7 (1)



# SIMATIC- Function block for easy programming in S7 (2)

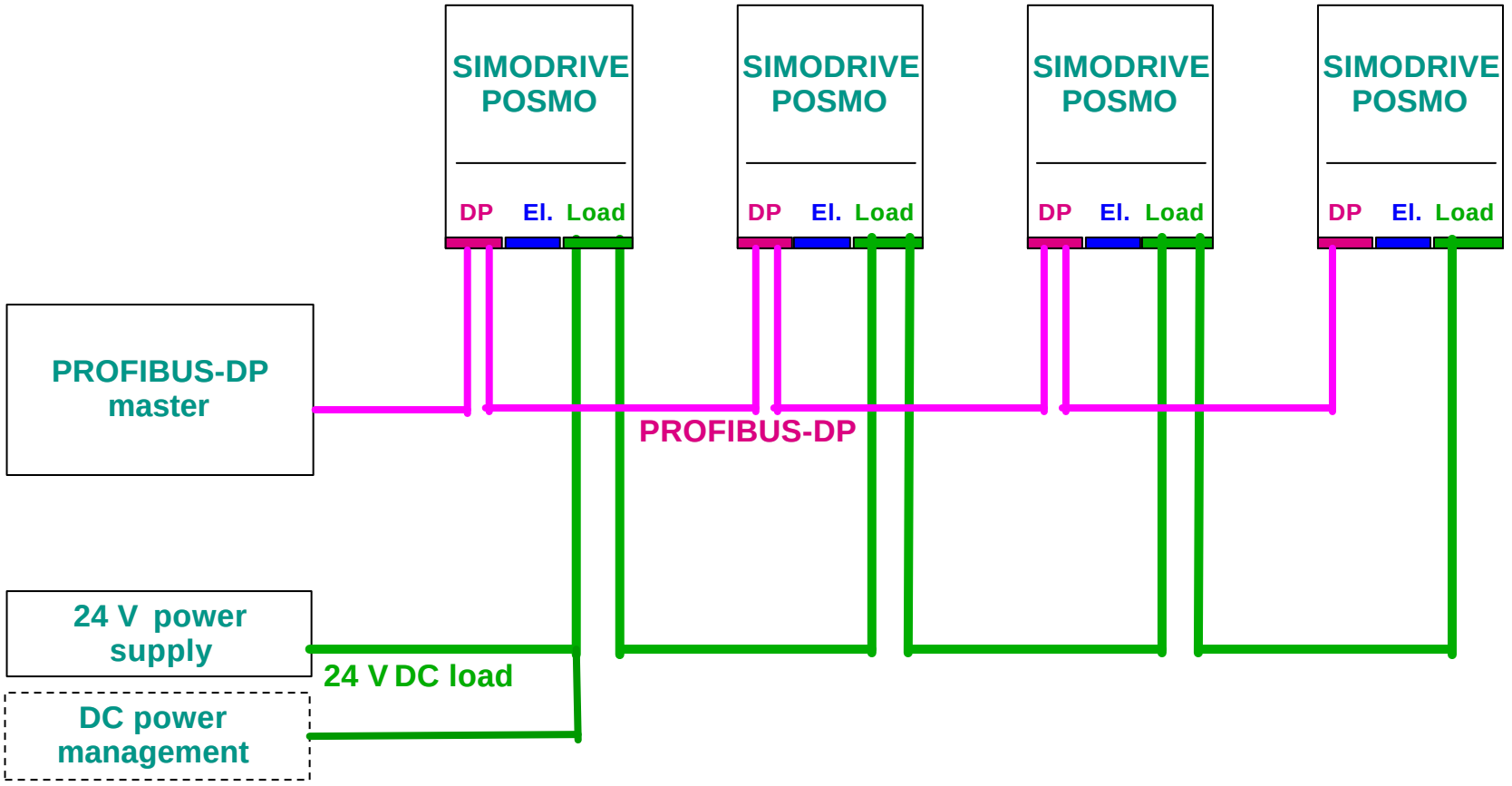


# SIMATIC- Function block for easy programming in S7 (3)



# 24 V DC networking concept (1)

## 24 V DC of the electronics from the load voltage



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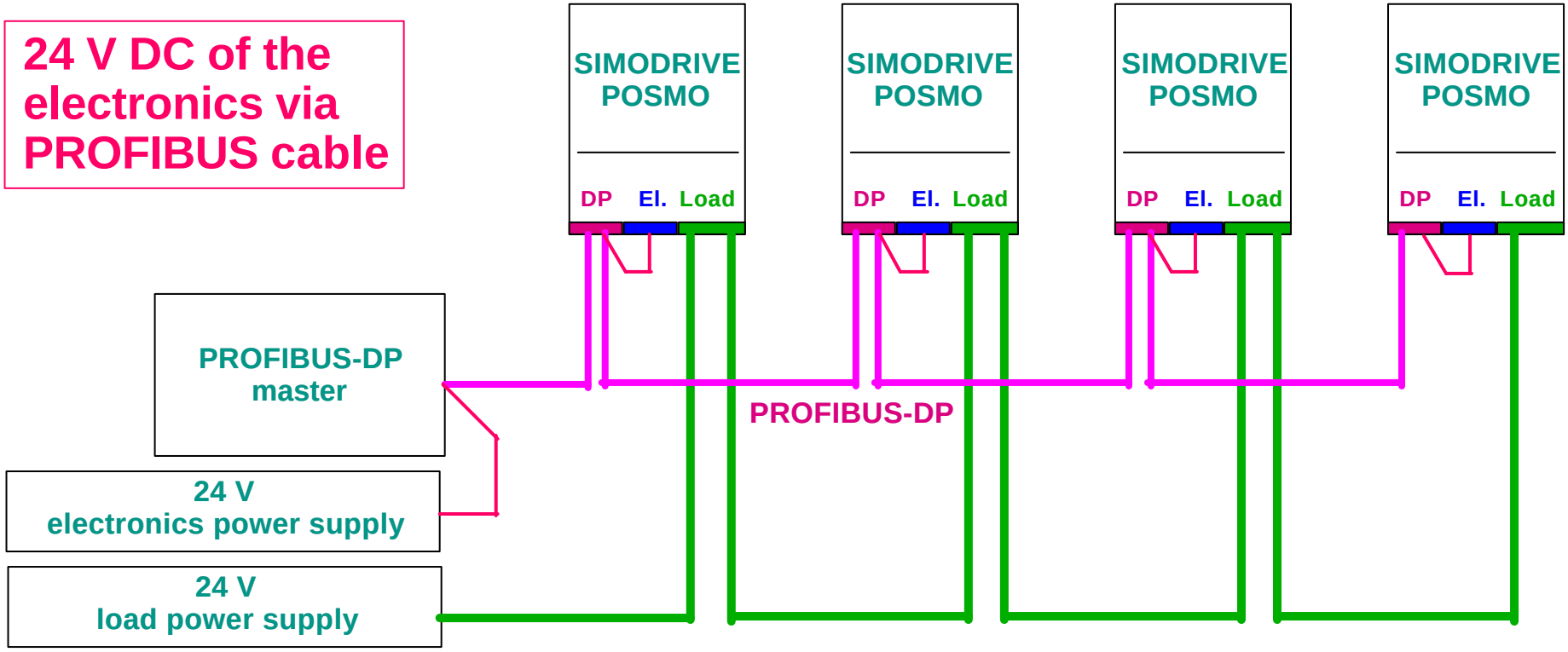
# 24 V DC - networking concept (2)

**24 V DC of the electronics via PROFIBUS cable**



# DC Power Management 24 V / 48 V

## Function

- Integrated pulsed resistor with I²t limiting
- Reverse current protection
- Connections for "start inhibit"
- Diagnostics
  - LED
  - Signals, fault acknowledgment via terminal

## Design/packaging

- Degree of protection IP20
- SIMATIC (S7-300) housing format
- For mounting directly on a C-type rail

# Catalog/Product Brief/Documentation

- NC 60 Ordering Catalog „SINUMERIK & SIMODRIVE“
- CA 01 Electronic Catalog „Automation Components“
- ST PI Components on Fieldbus „PROFIBUS & AS-Interface“

- **User Manual**

| | |
|---|---|
| Edition German | 6SN2197-0AA00-0AP1 |
| Edition English | 6SN2197-0AA00-0BP1 |
| Edition Italian | 6SN2197-0AA00-0CP1 |
| Edition French | 6SN2197-0AA00-0DP1 |
| Edition Spanish | 6SN2197-0AA00-0EP1 |

Available from: RLZE

- **Product Brief:**

| | | |
|---|---|---|
| Short Description, Ger. | Edition 11/98 | 6ZB5411-0AJ01-0BA2 |
| Short Description, Eng. | Edition 11/98 | 6ZB5411-0AJ02-0BA2 |

Available from: LZ Fürth

# Information in INTRANET

http://intra2.erlf.siemens.de

- **Parameterizing Tool POSMO A**
  For programming and parameterizing POSMO A via PC/PG/notebook
- **Function blocks**
  For easy programming in S7 programs
- **Dimension drawings in dxf format**
  For using in CAD programs
- **Applications POSMO A**
  Example applications
- **Documentation**
  User manual in German and English
- **GSD - File**
  For embedding POSMO A in S7 Profibus Master Sytems

# Training

- **POSMO A Training in Nuremberg Moorenbrunn (2 days)**
  The workshop is for service und sales personnel, who would like to operate Posmo A. A basic knowledge of S7 programming is helpful.
  Communication of Posmo A via PG and start-up tool as well as handling and programming in S7 are the main focus of this workshop.
- **Content**
  - Hardware and installation of Posmo A
  - Drive-functions of Posmo A
  - Connection and start-up on PROFIBUS-DP with programming examples
  - Communication via PROFIBUS DP using a PG with the start-up tool and S7-Master
  - Practical training with application examples
- Further information: Mr. Uebler +49 911 895 3209

# Single axis demonstation case

- Aluminium case with dimensions: 470x150x410 mm.
- SIMODRIVE POSMO A with gear
- Load disc + safety cover
- Connection module with on/off switch, fuses and service socket
- SITOP power supply 5A
- Power Management Module
- Reset switch for PMM
- BERO connected to POSMO A
- Profibus cable with Profibus plug

**6SN2832-0PG00-0AA0**

# 2 axis demonstration case

- Aluminium case with dimensions: 470x300x410 mm.
- SIMODRIVE POSMO A with Gear
- Load discs+ safety cover
- SIMATIC C7-626DP incl. signal cable, set up frame and Profibus plug
- Connection module with on/off switch, fuses and service socket
- SITOP power supply 5A
- Power Management Module
- Reset switch for PMM
- BERO connected to POSMO A
- Profibus cable with Profibus plug

**6SN2832-0CF00-0AA0**

# Contact Partners

| | |
|---|---|
| ☞ Hotline: | A&D MC CS, Erl F80,<br>Tel.: +49 180 525 8008<br>Fax: +49 180 525 8009 |
| ☞ Ordering Service: | A&D MC LOG KAM<br>Tel.: +49 9131-98-4333/4463/4304<br>Fax: +49 9131-98-1915 |
| ☞ Spare Parts Service: | A&D MC GWE ERZ<br>Tel.: +49 9131-98-1234<br>Fax: +49 9131-98-1164 |
| ☞ Repair Service: | A&D MC GWE RPZ<br>Tel.: +49 9131-98-1141<br>Fax: +49 9131-98-1655 |